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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/501,145

07/13/2004

Lieven Anaf

016782-0310

5358

22428 7590 01/22/2009
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EXAMINER

SCULLY, STEVEN M

ART UNIT

PAPER NUMBER

1795

MAIL DATE

DELIVERY MODE

01/22/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/501,145	Applicant(s) ANAF ET AL.	
	Examiner Steven Scully	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 January 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17, 19 and 20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17, 19 and 20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

POROUS METAL STACK FOR FUEL CELLS OR ELECTROLYSERS

Examiner: Scully S.N.: 10/501,145 Art Unit: 1795 January 15, 2009

DETAILED ACTION

1. The request for reconsideration filed 01/02/2009 has been entered. Claims 1-17 and 19-20 remain pending in the application.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

3. Claims 1-17 and 19-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Particularly, claims 1 and 3 define a stack as comprising an impermeable metal structure, and also define the stack as having a planar air permeability of more than 0.02 l/min*cm. It is unclear if the impermeable metal structure is intended to be included in the measuring of the air permeability across the stack because of its impermeability. Applicant is asked to clarify.

Claim Rejections - 35 USC § 103

4. The previous rejections of claims 1-6 and 9-17 under 35 U.S.C. 103(a) as being unpatentable over Cisar et al. (US6,562,507) are withdrawn in light of Applicant's remarks.

5. The previous rejections of claims 7-8 under 35 U.S.C. 103(a) as being unpatentable over Cisar et al. (US6,562,507) and Ramunni et al. (US6,022,634) are withdrawn in light of Applicant's remarks.

6. The previous rejections of claims 19-20 under 35 U.S.C. 103(a) as being unpatentable over Cisar et al. (US6,562,507) and Rosenmayer (US6,605,381) are withdrawn in light of Applicant's remarks.

7. Claims 1-4 and 9-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai et al. (US2003/0124413) in view of Appleby et al. (US6,770,394) and Cisar et al. (US6,562,507).

With respect to claim 1, Bai et al. disclose a fuel cell having an electrode layer with a micro-diffusion layer (30) having a given degree of porosity. The micro-diffusion layer may comprise individually discrete layers having a different porosity. See [0023]; Figure 1. Further is described macro-diffusion layer (40) made of carbon fiber that may also have discrete layers having different porosities and which, combined with the micro-diffusion layer (30), provides the gas diffusion layer (GDL). Further, the GDL in some forms may include only one of these two diffusion layers, which means that the GDL may be made of only a macro-diffusion layer comprising layers of varied porosities. See [0024]. Bai et al. also disclose an impermeable metal structure (80) which is a current collector of typically a metal. See [0028]. Bai et al. disclose that the

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porosity of the macro-diffusion layer (40) which is directly adjacent to the current collector (80) is greater than the porosity of the micro-diffusion layer (30) which is then on the opposite side of the macro-diffusion layer. See [0024]; Figure 1.

Bai et al. are silent regarding the specific parameters of the porosity of the gas diffusion layers. Appleby et al. disclose a fuel cell having a porous electrode and intermediate layers (gas diffusion layers). Appleby et al. recognize that the porosity of these layers have optimal values and are result effective variables. See [0087-0088]. The electrode performance improvement of the optimal porosity value can be correlated in a simple manner with the improved mass transport properties of the electrode active layer. See [0095]. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the porosity of the gas diffusion layers of Bai et al. because Appleby et al. teach it optimizes electrode performance.

Bai et al. are silent regarding sintering the layers. Cisar et al. disclose a stack comprising an impermeable metal structure (see claim 1, column 10, lines 44 to 45), one first metal fiber layer and one second metal fiber layer made of sintered metal fibers (see claim 2, column 10, lines 56 to 59), said impermeable metal structure being sintered to one side of said first metal fiber layer (see claim 1, column 10, lines 46 to 47), said second metal fiber layer being sintered to the other side of said first metal fiber layer (see claim 7). Cisar et al. further disclose that sintering provides full conductivity of the metal to be realized to provide superior performance. See column 6, lines 33-43. It would have been obvious to one of ordinary skill in the art to sinter the conductive materials of Bai et al. together to provide for full conductivity for superior performance.

Bai et al. in view of Appleby et al. and Cisar et al. do not explicitly teach the claimed planar air permeability. However, it is the position of the examiner that Bai et al. disclose multiple metal fiber layers which have the porosity optimized as taught by Appleby et al., which therefore, because air permeability is directly related to porosity, would inherently have a planar air permeability of more than 0.02 l/min*cm. Inherency is not established by probabilities or possibilities. *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51.

With respect to claim 2, Bai et al. disclose a fuel cell stack. See Figure 3. Obviously, another first and second metal fiber layer could be sintered to the other side of the current collector (80) of Bai et al. so as to form a fuel cell stack capable of higher outputs of energy.

With respect to claim 3, Bai et al. in view of Appleby et al. and Cisar et al. disclose the fuel cell as discussed above with respect to claim 1. Bai et al. do not disclose the porosity of the first metal fiber layer. However, as discussed above, the porosity of the metal fiber layers is a result effective variable. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the porosity of the first metal fiber layer of Bai et al. because Appleby et al. teach it optimizes electrode performance.

With respect to claim 4, Bai et al. in view of Appleby et al. and Cisar et al. do not explicitly disclose the perpendicular air permeability of the second metal fiber layer. However, it is the position of the examiner that Bai et al. disclose a second metal fiber layer which has the porosity optimized as taught by Appleby et al., which therefore,

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because air permeability is directly related to porosity, would inherently have a perpendicular air permeability of less than 200 l/min*dm². Inherency is not established by probabilities or possibilities. *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51.

With respect to claim 9, Bai et al. in view of Appleby et al. and Cisar et al. are silent with regard to said stack having a transversal electric resistance less than 30×10^{-3} Ohm. Cisar et al. disclose that the component or subassembly provides a metal structure having higher electrical conductivity than conventional bipolar plates or stack structures (see column 6, lines 18 to 20). It would have been obvious to one of ordinary skill in the art at the time of the invention to reduce the electric resistance in order to achieve higher electrical conductivity in the metal structure. Higher electrical conductivity in the invention can reduce the number of parts in the unit and thus making it lighter in weight.

With respect to claims 10 and 11, Bai et al. disclose the current collector (80) to be of traditional design and being made of metal. See [0028].

With respect to claims 12 and 14, Bai et al. are silent as to the metal fibers being stainless steel or titanium. Cisar et al. disclose forming gas diffusion layers from nickel, stainless steel, titanium and combinations thereof. See claim 23. It would have been obvious to one of ordinary skill in the art to substitute stainless steel or titanium because one of ordinary skill in the art would have reasonable expectations for the substitution to yield predictable results. *KSR International Co. v. Teleflex Inc. (KSR)*, 550 U.S. ___, 82 USPQ2d 1385 (2007).

With respect to claim 13, Bai et al. disclose the gas diffusion layer to be made of nickel. See [0037].

With respect to claim 15, Bai et al. in view of Appleby et al. and Cisar et al. disclose a stack as in claim 1, said metal fibers having the same alloy of said impermeable metal structure by combining all three structures into a single unitary metallic part which includes gas distribution structure by sintering, the gas diffusion structure, and the gas barrier structure (see abstract, lines 8 to 11 of Cisar et al.). It would have been obvious to one of ordinary skill in the art to sinter as discussed above with respect to claim 1.

With respect to claim 16, Bai et al. disclose the stacks of claim 1 used in a fuel cell. See Figure 3.

With respect to claim 17, Cisar et al. disclose using electrochemical cells in an electrolyser, and it is well known in the art that stack assemblies can be used in a fuel cell or an electrolyser, thus it would have been obvious to one of ordinary skill in the art at the time of the invention to use the stacks of claim 1 in an electrolyser.

8. Claims 5-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai et al. (US2003/0124413) in view of Appleby et al. (US6,770,394) and Cisar et al. (US6,562,507) as applied to claims 1-4 and 9-17 above, and further in view of Uchida et al. (US2002/0150808).

With respect to claims 5-6, Bai et al. in view of Appleby et al. and Cisar et al. are silent regarding the diameter of the fibers. Uchida et al. disclose a fuel cell comprising a

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gas diffusion layer made of metal fibers. See [0003]. Uchida et al. recognize that when the diameter is decreased it increases the porosity of the gas diffusion layer and improves gas permeability, but reduces electrical conductivity. See [0004]. Thus, diameter of the metal fibers is a result effective variable and it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the diameter of the fibers to adjust porosity, air permeability and electrical conductivity.

9. Claims 7 and 8 remain rejected under 35 U.S.C. 103(a) as being unpatentable over Cisar et al. (US6,562,507) as applied to claims 1-4 and 9-17 above, and further in view of Ramunni et al. (US6,022,634).

With respect to claims 7 and 8, Cisar et al. disclose a stack as in claim 1, said first metal fiber layers having a thickness of 1.1mm (column 8, lines 45 to 49) but does not disclose no more than 0.5mm or less than 0.2mm and said second metal fiber layers having a thickness of 1.1mm (column 8, lines 45 to 49) but does not disclose no more than 0.5mm or less than 0.2mm. Ramunni et al. teach metal fiber layer thickness of between 0.1 and 0.3mm (see column 3, lines 46 to 48). Ramunni et al. teach metal fiber layer thickness of between 0.1 and 0.3mm (see column 3, lines 46 to 48). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the thickness of the metal fiber layer, because Ramunni et al. teach the optimum thickness for the gas to travel to the reaction site is between 0.1 to 0.3 mm.

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10. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai et al. (US2003/0124413) in view of Appleby et al. (US6,770,394) and Cisar et al. (US6,562,507) as applied to claims 1-4 and 9-17 above, and further in view of Rosenmayer (US6,605,381).

With respect to claims 19 and 20, Bai et al. discloses that the macro-diffusion layer (40) comprises, in one form, a carbon fiber based sheet having a porosity, which is, as general matter, greater than the porosity of the micro-diffusion layer (30). See [0024]. However, this does not explicitly compare the porosities of the first and second fiber layers of Bai et al. Thus, Bai et al. in view of Appleby et al. and Cisar et al. are silent with regard to the porosity of the first and second metal fiber layers with respect to one another. Rosenmayer discloses a polymer-electrolyte membrane fuel cell having an inner 4 and an outer layer 3 of a gas diffusion structure. The gas diffusion structure 3,4 consists of porous, electrically conductive materials and is an orthogonale structure that must be adapted with respect to their pore volumes in order to achieve a gradient in terms of gas permeability. The outer layer 3 has a relatively small pore volume and consequently a high diffusion resistance. The inner part 4 of the gas diffusion structure, however, has a relatively high pore volume. Therefore, the reaction gases get distributed sufficiently well by way of diffusion within the inner layer 4. See Column 3, lines 48-67. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the first metal fiber layer of Cisar et al. with high pore volume and the second metal fiber layer of Cisar et al. with a low pore volume because

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Rosenmayer teaches the reaction gases get distributed sufficiently well by way of diffusion within the first metal fiber layer.

Response to Arguments

11. Applicant's arguments with respect to claims 1-17 and 19-20 have been considered but are moot in view of the new ground(s) of rejection.

Contact/Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven Scully whose telephone number is (571)270-5267. The examiner can normally be reached on Monday to Friday 7:30am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on (571)272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. S./

Examiner, Art Unit 1795

/Dah-Wei D. Yuan/

Supervisory Patent Examiner, Art Unit 1795